1. What is the effective ‘focal length’ for light passing a star of mass $M$ and radius $R$? That is, at what distance would parallel light passing on either side of the star be focussed to a point?

2. How good ($\Delta \nu / \nu$) a clock is needed to detect the gravitational light shift between the top and bottom of a 50 ft building? How does this compare with the latest NIST clocks?

3. When a rotating star collapses, centrifugal forces can prevent it from forming a black hole. Use dimensional analysis to estimate the necessary angular momentum required to prevent black hole formation from a star of angular momentum $L$ and mass $M$.

4. Suppose a 1 solar mass star becomes a black hole. What would be the maximum distance an “earth” could be situated outside the black hole without being torn apart by tidal forces?

5. Use dimensional analysis to estimate the power radiated by a black hole of mass $M$ due to Hawking radiation. Since Hawking radiation is a quantum effect, you can assume that the power is proportional to $h$. The estimate turns out to be too large by a factor of merely $20720\pi^2$! Using the correct factor, estimate the lifetime of a 1 solar mass black hole.